

# MATH 116 — PRACTICE FOR EXAM 2

Generated February 15, 2016

NAME: \_\_\_\_\_

INSTRUCTOR: \_\_\_\_\_ SECTION NUMBER: \_\_\_\_\_

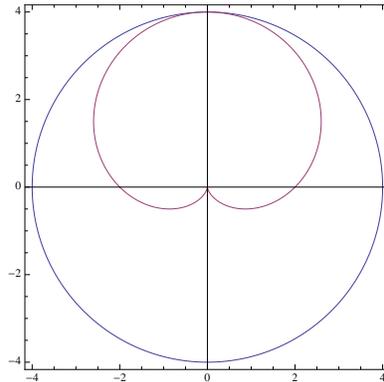
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1. This exam has 2 questions. Note that the problems are not of equal difficulty, so you may want to skip over and return to a problem on which you are stuck.
2. Do not separate the pages of the exam. If any pages do become separated, write your name on them and point them out to your instructor when you hand in the exam.
3. Please read the instructions for each individual exercise carefully. One of the skills being tested on this exam is your ability to interpret questions, so instructors will not answer questions about exam problems during the exam.
4. Show an appropriate amount of work (including appropriate explanation) for each exercise so that the graders can see not only the answer but also how you obtained it. Include units in your answers where appropriate.
5. You may use any calculator except a TI-92 (or other calculator with a full alphanumeric keypad). However, you must show work for any calculation which we have learned how to do in this course. You are also allowed two sides of a  $3'' \times 5''$  note card.
6. If you use graphs or tables to obtain an answer, be certain to include an explanation and sketch of the graph, and to write out the entries of the table that you use.
7. You must use the methods learned in this course to solve all problems.

Semester	Exam	Problem	Name	Points	Score
Fall 2010	2	2	cardioid	14	
Winter 2014	2	9	pond rock	10	
Total				24	

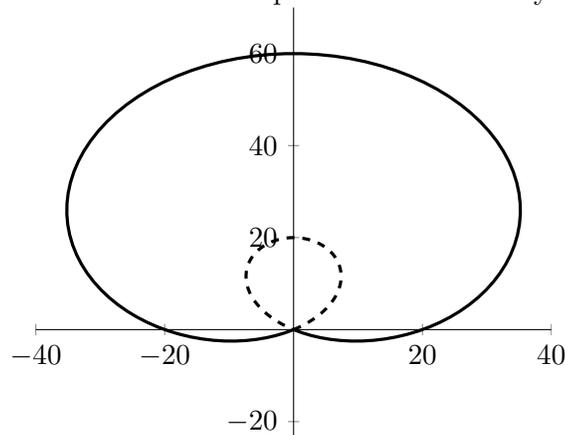
**Recommended time (based on points): 22 minutes**

2. [14 points] The graph of the circle  $r = 4$  and the cardioid  $r = 2 \sin \theta - 2$  are shown below.



- a. [3 points] Write a formula for the area inside the circle and outside the cardioid in the first quadrant.
- b. [7 points] At what angles  $0 \leq \theta < 2\pi$  is the minimum value of the  $y$  coordinate on the cardioid attained? No credit will be given for answers without proper mathematical justification.
- c. [4 points] Write an integral that computes the value of the length of the piece of the cardioid lying below the  $x$ -axis.

9. [10 points] Linda is designing a pond with a flat rock at one end. The rock plus the pond are in the shape of a cardioid. Plans for her pond design are depicted below. The cardioid has equation  $r = 20 + 40 \sin \theta$  where  $r$  is in feet and  $\theta$  is in radians. The inner loop of the cardioid forms the shape of the rock and the outer loop forms the boundary of the pond.



- a. [2 points] Find all values of  $\theta$  between 0 and  $2\pi$  for which  $r = 0$ .
- b. [4 points] Write an integral or sum of integrals which give(s) the perimeter of the boundary of the pond. Note this is the perimeter of the part of the cardioid drawn with a solid line.
- c. [4 points] Write an integral or sum of integrals which give(s) the area of the top of the rock. Note this is the area enclosed by the dashed part of the cardioid.